**EEX5362 - Performance Modelling**

**Mini Project**

**Deliverable 01**

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# ****High-Level Problem Description****

**System Name:** Hospital OPD Pharmacy Queue System (Clinic Patients Collecting Medicine)

In a majority of government hospitals in Sri Lanka, the patients visiting the clinics are expected to collect their prescribed medicines at the OPD pharmacy. It is common in this process and leads to long queues more so in the morning hours when the clinic sessions are coming to an end. Patients queue to deliver prescriptions and the pharmacists attend to them in order of arrival.

Patients are large and the pharmacy counters are few and, thus, a bottleneck exists which contributes to more waiting time, low service efficiency as well as patient dissatisfaction.

This mini project aims at studying the performance of the pharmacy queue system whereby the measurable metrics that are captured include the waiting time, service time, the overall time the system spends in the queue and the utilization of the pharmacist. Its aim is to gain knowledge of the behavior of queues and possible ways of improvement.

# System Description

|  |  |
| --- | --- |
| **System name** | Hospital OPD Pharmacy Queue System |
| **Type** | Healthcare delivery process |
| **Location context** | Government hospitals in Sri Lanka |
| **Key components** | Clinic patients, OPD pharmacy, pharmacists, medicine dispensing counters |
| **Process flow** | Patients arrive → Join queue → Wait → Get served → Exit system |
| **Performance Focus** | Waiting time, Service time, Total system time, Pharmacist utilization |

Table 1: System Details

The model targets the clinic patients alone as they visit the clinic with prescriptions after their visit. The waiting time, service time, and total time of each patient in the system are recorded to determine the bottlenecks and propose improvements in the areas of performance.

# System Parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Description** | **Example / Range** |
| Patient arrival rate | The rate at which patients arrive at the pharmacy. | 1 patient every 2–5 minutes |
| Number of Pharmacists / Servers | The number of pharmacists serving the queue simultaneously. | 2 (PH1, PH2) |
| Service time | Time taken by a pharmacist to dispense medicines to a patient. | 3–7 minutes depending on prescription complexity |
| Patient priority | Whether the patient is normal or urgent | Normal, Urgent |
| Prescription type | Complexity of the prescription, affects service time. | Simple, Complex |
| Waiting time | Time a patient spends waiting in the queue before service begins. | 0–20 minutes (depends on queue length) |
| Service start time | Exact time when pharmacist starts serving a patient. | Calculated based on arrival and queue |
| Service end time | Time when dispensing is completed. | Service Start Time + Service Time |
| Total time in system | Total time patient spends in pharmacy (Waiting Time + Service Time). | 5–25 minutes |
| Queue discipline | The order in which patients are served. | First served method with priority for urgent patients |
| Peak hours | Time periods with higher patient arrivals. | 9:00 AM – 12:00 PM (morning clinic closing) |
| Resource utilization | Percentage of pharmacist time spent serving patients versus idle. |  |
| Patient type | Patients who visit clinics |  |

Table 2: Parameters and Descriptions

# Performance Objectives

* Reduce waiting time on the average - This is aimed at minimizing the number of minutes that patients are required to wait in the queue until they are given their medicines.
* Maximize throughput - The system must be able to work with the largest number of patients in an hour without raising the total waiting time.
* Maximize pharmacist workload - Pharmacist is supposed to be efficiently distributed in a way that he/she is not overworked or idling.
* Identify bottlenecks - The research will be used to identify moments in the pharmacy process where the queues become too long like during prescription verification or checking on medicine dispensing.
* Improve queue management - The system ought to consider the effects of queue policies, including first come, first served or prioritisation of emergency patients to provide fair and timely services to everyone.
* Reduce total time in system - Reduce the overall amount of time a patient spends in the pharmacy, including the arrival and service delivery, to increase the patient experience and efficiency.
* Plan for peak hours - Monitor the performance of a system under the peak period of patient arrival in order to detect the possible delays and optimize the staffing or resources allocation at the time of peak.

# Expected Outcomes

* Quantitative information of average waiting time, service rate, and utilization of pharmacists.
* Determination of the areas of performance congestion during the peak clinic hours.
* Efficiency suggestions, including the hiring of more staff, time management scheduling, or the use of digital queue management.

# Conclusion

This deliverable introduces the Hospital OPD Pharmacy Queue System to be evaluated in terms of performance. The major aims are to decrease waiting time, improve throughput and maximize the utilization of pharmacist. The system parameters and dataset offer a foundation upon which the future analysis and modeling can be undertaken in order to enhance the efficiency of pharmacy services.